

# American River Basin: Downtown Combined Sewer Upsizing Project

## Attachment 8: Economic Analysis – Water Supply Costs and Benefits

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The Downtown Combined Sewer Upsizing Project provides a broad array of benefits within the American River Basin (ARB) Region and externally to the Sacramento-San Joaquin Delta (Delta). While some of these benefits may be quantifiable via economic analyses, many benefits provided by the project cannot be quantified due to their complex nature. This attachment provides economic analyses of water supply benefits expected as a result of implementation of the Downtown Combined Sewer Upsizing Project. In general, this Project will provide indirect water supply reliability benefits.

### Summary

The Downtown Sewer Upsizing Project is a portion of the City of Sacramento’s Combined Sewer System Improvement Program (CSSIP). The City has completed similar improvements downstream, and in conjunction with them, the Downtown Combined Sewer Upsizing Project will reduce combined system overflows (CSOs) to the Sacramento River and reduce flooding of combined stormwater runoff and sewage (termed “CSS outflows”) in the downtown area of Sacramento. Thus, the project will meet multiple planning objectives: reduce flood damage in the economically vital downtown area of Sacramento, improve water quality in the Sacramento River (the source of drinking water for millions of Californians), and protect public health by reducing the likelihood and volume of diluted sewage on streets and properties and discharged to the Sacramento River.

The Downtown Sewer Upsizing Project was first conceived by City hydrologists in the 1990’s to address the ongoing flooding problems in the Downtown area. Previously completed portions of the project include the U and S Street Parallel Sewer (completed in 2007) and replacement of existing combined sewer trunk mains with larger pipelines (upsizing) and constructing parallel pipelines in S Street, 5<sup>th</sup> Street and in the alley between J and K Streets (completed in 2010). These projects served to both increase conveyance to the Sump 1/1A complex, which had been improved in 1997, and reduced the hydraulic grade line in the vicinity of the improvements, including a vulnerable flooding location at 5<sup>th</sup> and U Streets. It also provided hydraulic improvements to reduce odors and improve pumping efficiency at Sump 1 and Sump 2.

To complete the Downtown Sewer Upsizing Project, it is necessary to continue the “upsizing” in 7<sup>th</sup> Street to connect with a section upstream that was constructed out of sequence due to timing constraints, and to extend this network of upsized pipes in L, G, F, and 8<sup>th</sup> Street. For the project to function properly, it is necessary that it be continuous, without bottleneck sections like currently exist. Once completed, the network of upsized and parallel pipes will serve to lower the hydraulic grade line in this portion of the City with critical and high value real estate that has experienced flooding of combined sewer outflows in the past. The Downtown Sewer Upsizing Project will replace existing pipelines with larger pipes by paralleling the existing pipeline or by connecting new pipes to upsized portions, whichever approach is determined to be most practical. Replacing the pipelines has the added benefit of renewing pipes that have long since exceeded their useful lives. For example, the pipes in 7<sup>th</sup> Street and S Street are mostly constructed of clay bricks and were constructed in the 1890’s. As such, they are not reliable and have been known to fail suddenly.

In addition to the benefits provided to the downtown Sacramento area due to reduced combined sewer outflows, the project will also benefit water suppliers utilizing Freeport Regional Water Authority’s (FRWA) intake structure. As the FRWA intake facility is located three miles downstream of downtown Sacramento on the Sacramento River; any combined sewer overflows occurring in the City and entering the river has direct significant negative impacts on the river’s water quality and therefore affects water entering the FRWA intake structure.

## Summary of Costs and Benefits

As documented in Attachment 4, the budgetary estimate for the Project is \$13,109,359. The total present value of the project is \$5,335,325 and is based on a 50-year project life cycle, which is consistent with the life cycle assumed in the flood damage reduction benefit analysis. This present value cost of the project does not include \$6,776,064 in sunk costs for previously replaced pipeline sections in the downtown area.

The majority of the budget (approximately 90%) for the Downtown Combined Sewer Upsizing Project is for project construction/implementation, with a portion of the budget for planning, environmental review, permitting and design (9%) in addition to smaller amounts for direct project administration, a project contingency, environmental compliance, and construction administration. Project costs will be spread out over an implementation period between September of 2011 and December of 2013. There are no maintenance, administration, operation or replacements costs assumed for this project as the project is a pipeline upsizing and there no anticipated incremental increases in costs for any of these categories.

A summary of the benefits and costs for the project is provided in Table 1. Total present value costs for this project are \$5,335,325 and are illustrated in Table 2.

**Table 1: Benefit-Cost Analysis Overview**

	Present Value
<u>Costs</u> – Total Capital and O&M	\$5,335,325
<u>Monetized Benefits</u>	
Flood Control Benefits	
Expected Flood Benefits	\$9,803,508
Water Quality and Other Benefits	
Avoided Cleanup Costs	\$370,395
Willingness to Pay for Improved Surface Water Quality	\$306,029
Avoided Health-Related Work Impacts	\$13,286
Avoided Litigation Resulting from CSS Outflows	\$2,723,626
Total Monetized Benefits	\$13,216,844
<u>Qualitative Benefit or Cost</u>	Qualitative indicator*
Water Supply Benefits	
Reduction in potential impacts and closure to downstream water supply intake at Freeport	+
Water Quality Benefits	
Reduction in combined sewage discharges and pollutant loading into Sacramento River	++
Other Benefits	
Avoided Public Health impacts associated with direct contact with combined sewage spills in Downtown Sacramento	++
<p>O&amp;M = Operations and Maintenance</p> <p>* Direction and magnitude of effect on net benefits:</p> <p>+ = Likely to increase net benefits relative to quantified estimates.</p> <p>++ = Likely to increase net benefits significantly.</p> <p>– = Likely to decrease benefits.</p> <p>– – = Likely to decrease net benefits significantly.</p> <p>U = Uncertain, could be + or –.</p>	

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**Table 2: Annual Cost of Project**  
**(Referenced as Table 14 in Exhibit D of the Proposition 1E Grant PSP)**

Table 2 - Annual Cost of Project									
Project: Downtown Combined Sewer Upsizing Project									
Year	Initial Costs	Operations and Maintenance Costs						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Capital and Other Initial Costs	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a)+...+(f)	Discount Factor	Discounted Costs (g) x (h)
2009	\$0	\$0	\$0	\$0	\$0	\$0	\$0	1.00	\$0
2010	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.94	\$0
2011	\$2,154,031	\$0	\$0	\$0	\$0	\$0	\$2,154,031	0.89	\$1,917,080
2012	\$2,269,854	\$0	\$0	\$0	\$0	\$0	\$2,269,854	0.84	\$1,905,813
2013	\$1,909,410	\$0	\$0	\$0	\$0	\$0	\$1,909,410	0.79	\$1,512,431
2014	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.75	\$0
2015	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.70	\$0
2016	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.67	\$0
2017	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.63	\$0
2018	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.59	\$0
2019	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.56	\$0
2020	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.53	\$0
2021	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.50	\$0
2022	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.47	\$0
2023	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.44	\$0
2024	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.42	\$0
2025	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.39	\$0
2026	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.37	\$0
2027	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.35	\$0

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Year	Initial Costs	Operations and Maintenance Costs						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Capital and Other Initial Costs	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a)+...+(f)	Discount Factor	Discounted Costs (g) x (h)
2028	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.33	\$0
2029	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.31	\$0
2030	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.29	\$0
2031	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.28	\$0
2032	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.26	\$0
2033	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.25	\$0
2034	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.23	\$0
2035	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.22	\$0
2036	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.21	\$0
2037	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.20	\$0
2038	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.18	\$0
2039	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.17	\$0
2040	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.16	\$0
2041	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.15	\$0
2042	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.15	\$0
2043	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.14	\$0
2044	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.13	\$0
2045	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.12	\$0
2046	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.12	\$0
2047	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.11	\$0
2048	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.10	\$0
2049	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.10	\$0

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Year	Initial Costs	Operations and Maintenance Costs						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Capital and Other Initial Costs	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a)+...+(f)	Discount Factor	Discounted Costs (g) x (h)
2050	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.09	\$0
2051	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.09	\$0
2052	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.08	\$0
2053	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.08	\$0
2054	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.07	\$0
2055	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.07	\$0
2056	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.06	\$0
2057	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.06	\$0
2058	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.06	\$0
2059	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.05	\$0
2060	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.05	\$0
2061	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.05	\$0
2062	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.05	\$0
2063	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.04	\$0
2064	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.04	\$0
2065	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.04	\$0
	Total Present Value of Discounted Costs (Sum of Column (i))								<b>\$5,335,325</b>

Comments: This project does not include maintenance costs as the continued maintenance costs associated with sewer cleaning are not affected by the pipeline upsizing. Therefore, there is no incremental increase in the amount of sewer cleaning, repair, and inspection. Project life is considered to be 50 years, which is consistent with the life cycle assumed in the flood damage reduction benefit analysis.

## The “Without Project” Baseline

The City’s current combined sewer infrastructure is insufficient to handle large storms, resulting in raw sewage overflows onto streets in Downtown Sacramento and into the adjacent Sacramento River. As the downtown Sacramento area is highly populated, the sewage overflows present a public health risk in addition to associated flood damages and water quality impacts.

In 1990, the Central Valley Regional Water Quality Control Board served the City with a Cease and Desist Order that directed the City to devise a plan to reduce its CSO’s and CSS outflows. The Downtown Combined Sewer Upsizing Project would increase the conveyance capacity and in-system storage of the combined sewer system, significantly reducing the frequency and volume of combined sewage spills and discharges. Without this project, alternative projects would need to be developed to meet the requirements in the Regional Board’s Cease and Desist Order and/or sewer outflows would continue at the current rate, posing public health, water quality and water supply impacts.

## Water Supply Benefits

Although no water supply benefits have been monetized, one water supply benefit has been identified for the Downtown Combined Sewer Upsizing Project.

### *Reduction in Potential Impacts to Downstream Drinking Water Intakes*

The project described herein is a stormwater flood management project, and due to its nature (combined sewer flows), does not provide any significant water supply benefits. However, the Downtown Combined Sewer Upsizing Project will reduce the amount of raw sewage released to the Downtown area and the adjacent Sacramento River. The Freeport Regional Water Authority’s (FRWA) intake structure, located three miles downstream of downtown Sacramento on the Sacramento River, has the potential to be impacted by increased pollutant loading to the river upstream of the intake. In essence, any combined sewer overflows occurring in the City and entering the river has direct significant negative impacts on the river’s water quality and therefore affects water entering the FRWA intake structure. This project will ameliorate this problem and will therefore provide water supply reliability benefits.

## Distribution of Project Benefits

Beneficiaries of this project include the population living and working in the downtown Sacramento area, the water suppliers who utilize the Sacramento River as a water source, and the Delta due to better water quality protections.

**Table 3: Project Beneficiaries Summary**

Local	Regional	Statewide
Population in and near downtown Sacramento	Water Suppliers using the Sacramento River; visitors to downtown Sacramento	Sacramento River and the Delta

### Project Benefits Timeline Description

The project's water supply benefits will incrementally improve as each phase of the project is completed and the frequency of raw sewage releases decreases. Previously completed portions of the project have reduced combined sewer outflows by about 42% since the project inception. Further improvements are anticipated upon completion of Phases 1, 2 and 3. Phase 1 is anticipated to be completed in December, 2011; Phase 2 is anticipated to be completed in October, 2012; and Phase 3 is anticipated to be completed in September 2013. Incremental benefits will be realized following completion of each project phase.

### Potential Adverse Effects from the Project

There are no potential adverse effects associated with the project.

### Summary of Findings, Tables

The Downtown Combined Sewer Upsizing Project does not have any monetized water supply benefits. The Project does, however, convey water supply benefits along with flood damage reduction benefits (which are the primary motivation for the project) and water quality benefits. The Project will reduce frequency and volume of combined sewer overflows in the downtown Sacramento area, and combined sewer releases into the adjacent Sacramento River, thereby limiting potential impacts to downstream drinking water intakes. Implementation of this project will help protect downstream water supply, public health in the downtown area, and water quality in the Sacramento River. These benefits are summarized in Table 4.

**Table 4: Qualitative Benefits Summary – Water Supply Benefits**

Benefit	Qualitative Indicator
Reduction in potential impacts and closure to downstream water supply intake at Freeport	+

In addition, this project will convey water quality and other benefits through the reduction in raw sewage releases to the Sacramento River and the reduced potential for public health exposure to raw sewage.



**Table 5: Qualitative Benefits Summary – Water Quality and Other Benefits**

Benefit	Qualitative Indicator
Protects public health by reducing combined sewer overflows in the downtown Sacramento area and the adjacent Sacramento River	+
Protects Water Quality for downstream water suppliers who depend on the Sacramento River and the Delta	+

## Omissions, Biases and Uncertainties

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In this analysis, the main uncertainties are associated with the extent to which this project contributes to mitigating risks posed by the releases of raw sewage as a result of combined sewer outflows. These issues are listed in Table 6.

**Table 6: Omissions, Biases, and Uncertainties, and Their Effect on the Project**

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Avoided costs of purchased water associated with intake shutdown from water quality impacts	U	The projected avoided costs/impacts are based on a range of factors that may vary over time, including the severity and frequency of 100-year or greater storm events.
*Direction and magnitude of effect on net benefits: + = Likely to increase net benefits relative to quantified estimates. ++ = Likely to increase net benefits significantly. - = Likely to decrease benefits. -- = Likely to decrease net benefits significantly. U = Uncertain, could be + or -.		